# KERATINOPHILIC FUNGI OF CHICKEN AND PIGEON CLAWS FROM EGYPT

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ABSTRACT - 52 species belonging to 24 genera were collected from chicken and pigeon claws (100 samples each) using sterilized moistened clay soils at 28°C. The most common genera were *Chrysosporium*, *Penicillium*, *Scopulariopsis* and *Aspergillus* followed by *Mucor*, *Alternaria* and *Fusarium*. Several keratinophilic fungi were recovered, but with variable counts and frequency, from any or the 2 types of claws such as *Chrysosporium keratinophilum*, *C. tropicum*, *C. indicum*, *C. pannorum*, *C. luteum*, *C. asperatum*, *C. dermatitidis*, *Arthroderma tuberculatum*, *Allescheria boydii*, *Ctenomyces serratus*, *Corynascus sepedonium* and *Geotrichum candidum*. Also, numerous species of cycloheximide resistant fungi were isolated of which *P. chrysogenum*, *P. cyclopium*, *S. brevicaulis*, *A. flavus*, *A. zonatus*, *M. pusillus*, *Alternaria alternata*, *F. solani* and *Acremonium strictum* were prevalent on the two substrates.

RÉSUMÉ - 52 espèces appartenant à 24 genres fongiques ont été isolées à partir d'échantillons d'ongles de poulets et de pigeons. Les genres les plus communs sont *Chrysosporium*, *Penicillium*, *Scopulariopsis* et *Aspergillus*, suivis par *Mucor*, *Alternaria* et *Fusarium*. Plusieurs champignons kératinophiles ont été trouvés, avec des fréquences variables: *Chrysosporium keratinophilum*, *C. tropicum*, *C. indicum*, *C. pannorum*, *C. luteum*, *C. asperatum*, *C. dermatitidis*, *Arthroderma tuberculatum*, *Allescheria boydii*, *Ctenomyces serratus*, *Corynascus sepedonium* et *Geotrichum candidum*. De même, de nombreuses espèces résistantes à l'actidione ont été isolées. Les plus fréquentes sont: *P. chrysogenum*, *P. cyclopium*, *S. brevicaulis*, *A. flavus*, *A. zonatus*, *M. pusillus*, *Alternaria alternata*, *F. solani* et *Acremonium strictum*.

KEY WORDS : keratinophilic fungi, cycloheximide resistant fungi, claws fungi, chicken fungi, pigeon fungi.

## INTRODUCTION

Several investigations have been made on the dermatophytes and other keratinophilic fungi from the hair of mammals in different places all over the world (Ajello, 1959; Marples, 1961; Alteras & al., 1966; Rees, 1967; Smith & al., 1969; Hoffmann & al., 1970; Abdel-Hafez, 1987).

In Egypt, numerous surveys were carried out on keratinophilic fungi from various substrates (Moawad, 1969; Abou-Gabal & Abdelrahiem, 1973; Mostafa, 1977; Bagy & Abdel-Hafez, 1985; Bagy, 1986), but none of these studies were focused on claws of birds. The present investigation aims to be an intensive study on the composition and counts of keratinophilic and cycloheximide resistant fungi on claws of chickens and pigeons from Sohag Governorate (Egypt).

## MATERIALS AND METHODS

One hundred samples of claws of each of healthy chickens and pigeons, of 8 claws each, were collected during January-April 1987 from the previous 2 bird types from various pens from Sohag Governorate (Egypt). These claws samples were placed in clean sterilized plastic bags and transferred immediately to the Mycological Laboratory and stored at 3.5°C.

**Determination of claws fungi:** The claws baiting technique was employed. Four claws of each chicken and pigeon placed on sterile soil moistened with sterilized distilled water (20-25% moisture content) and remoistened whenever necessary. Two plates were used for each sample and the plates were incubated at 28°C for 10-12 weeks. The moulds which appeared on the baits were examined microscopically and fungi were transferred to the surface of Sabouraud's dextrose agar medium (Moss & Mc Quown, 1969) which was supplemented with 20 units ml of sodium penicillin, 40µg ml of the dihydrostreptomycin and 0.05% cycloheximide (actidione). Before adding to the medium, the first 2 antibiotics were dissolved separately in sterile distilled water while the third was dissolved in methanol. The plates were incubated at 28°C for 4-6 weeks and the developing fungi were counted, identified and calculated per 8 claws of each of chickens and pigeons.

Table 1 - Total counts, number of cases of isolation and occurrence remarks of fungal genera and species recovered from chicken and pigeon claws.

Tableau 1 - Genres et espèces de champignons isolés à partir d'ongles de poulets et de pigeons.

| Birds examined | Chickens | | | Pigeons | | |
|---|---|---|---|---|---|---|
| Genera and species | TC | NCI | OR | TC | NCI | OR |
| Total count | 1340 | - | - | 725 | - | - |
| *Chrysosporium* (total count) | 173 | 43 | M | 77 | 27 | M |
| *C. keratinophilum* (Frey) Carmichael | 71 | 28 | M | 30 | 18 | L |
| *C. tropicum* Carmichael | 40 | 17 | L | 23 | 13 | L |
| *C. indicum* (Rand. & Sand.) Garg | 25 | 13 | L | 15 | 10 | R |
| *C. pannorum* (Link) Hughes | 13 | 8 | R | - | - | - |
| *C.* state of *Thielavia sepedonium* Emmons | 10 | 5 | R | 6 | 2 | R |
| *C. luteum* Constantin | 6 | 4 | R | - | - | - |
| *C. asperatum* Carmichael | 8 | 3 | R | - | - | - |
| *C. dermatitidis* Gilchrist & Stokes | - | - | - | 3 | 2 | R |
| *Arthroderma tuberculatum* Kuehn | 21 | 13 | L | 11 | 7 | R |
| *Allescheria boydii* Shear | 6 | 4 | R | - | - | - |
| *Ctenomyces serratus* Eidam | 5 | 3 | R | 3 | 2 | R |

| | | | | | | |
|---|---|---|---|---|---|---|
| *Corynascus sepedonium* (Emmons) v. Arx | 3 | 2 | R | - | - | - |
| *Penicillium* (total count) | 250 | 41 | M | 103 | 26 | M |
| *P. chrysogenum* Thom | 138 | 32 | M | 52 | 20 | L |
| *P. cyclopium* Westling | 30 | 13 | L | 18 | 5 | R |
| *P. funiculosum* Thom | 27 | 11 | R | 15 | 6 | R |
| *P. janthinellum* Biourge | 33 | 9 | R | 11 | 4 | R |
| *P. nigricans* Bainier | 14 | 5 | R | 7 | 2 | R |
| *P. frequentans* Westling | 6 | 3 | R | - | - | - |
| *P. granulatum* Bain. | 2 | 1 | R | - | - | - |
| *Scopulariopsis brevicaulis* (Sacc.) Bainier | 218 | 40 | M | 154 | 25 | M |
| *Aspergillus* (total count) | 143 | 38 | M | 76 | 25 | M |
| *A. flavus* (Link) Fres. | 55 | 24 | M | 32 | 14 | L |
| *A. zonatus* Kwon & Fennell | 26 | 14 | L | 14 | 8 | R |
| *A. fumigatus* Fres. | 34 | 11 | R | 10 | 6 | R |
| *A. ochraceus* Wilhelm | 10 | 8 | R | 13 | 5 | R |
| *A. nidulans* Eidam | [illegible] | 6 | R | - | - | - |
| *A. niger* Van Tiegh. | 5 | 3 | R | 2 | 1 | R |
| *A. terreus* Thom | 4 | 2 | R | 5 | 3 | R |
| *A. tamarii* Kita | 1 | 1 | R | - | - | - |
| *Mucor* (total count) | 160 | 31 | M | 88 | 20 | L |
| *M. pusillus* Lindt | 122 | 21 | L | 55 | 16 | L |
| *M. hiemalis* Wehmeyer | 38 | 12 | R | 33 | 9 | R |
| *Alternaria alternata* (Fr.) Keissler | 106 | 30 | M | 64 | 25 | L |
| *Fusarium* (total count) | 92 | 26 | M | 44 | 18 | L |
| *F. solani* (Mart.) Sacc. | 38 | 13 | L | 27 | 14 | L |
| *F. oxysporum* Schlecht. | 27 | 10 | R | 14 | 6 | R |
| *F. moniliforme* Sheldon | 15 | 6 | R | - | - | - |
| *F. equiseti* (Corda) Sacc. | 7 | 4 | R | 3 | 2 | R |
| *F. dimerum* Penz. | 5 | 2 | R | - | - | - |
| *Rhizopus stolonifer* (Ehrenb. ex Fr.) Lindt | 16 | 14 | L | 19 | 13 | L |
| *Acremonium* (total count) | 54 | 13 | L | 28 | 10 | R |
| *A. strictum* W. Gams | 28 | 8 | R | 21 | 8 | R |
| *A. rutilum* W. Gams | 23 | 6 | R | 7 | 3 | R |
| *A. murorum* (Corda) W. Gams | 3 | 1 | R | - | - | - |
| *Verticillium* (total count) | 18 | 10 | R | 4 | 3 | R |
| *V. catenulatum* (Kamy. ex Barron & Onions) W. Gams | 11 | 6 | R | 4 | 3 | R |
| *V. chlamydosporium* Goddard | 7 | 5 | R | - | - | - |
| *Geotrichum candidum* Link ex Leman | 21 | 7 | R | 20 | 10 | L |
| *Ulocladium atrum* Preuss | 11 | 5 | R | - | - | - |
| *Chaetomium* (total count) | 7 | 4 | R | 6 | 4 | R |
| *C. spirale* Zopf | 7 | 4 | R | - | - | - |
| *C. globosum* Kunze ex Fr. | - | - | - | 6 | 4 | R |
| *Paecilomyces lilacinus* (Thom) Samson | 5 | 3 | R | - | - | - |
| *Cylindrocarpon didymum* (Hartig) Wollenw. | 2 | 1 | R | 6 | 4 | R |
| *Arthrobotrys oligospora* Corda | 2 | 1 | R | - | - | - |
| *Botryotrichum piluliferum* Saccardo & Marchal | 2 | 1 | R | 7 | 4 | R |
| *Cladosporium cladosporioides* (Fres.) De Vries | - | - | - | 3 | 2 | R |
| *Syncephalastrum racemosum* Cohn ex Schroeter | - | - | - | 2 | 1 | R |
| *Saccharomyces* spp. | 15 | 10 | R | 6 | 4 | R |
| Mycelia sterilia | 10 | 6 | R | 4 | 3 | R |

TC – total count (calculated per 8 claws in every sample or per 800 claws). NCI = number of cases of isolation (out of 100 samples or 100 birds). OR = occurrence remarks: H – high occurrence; between 50-100 cases. M – moderate occurrence; between 25-49 cases. L = low occurrence; between 13-24 cases. R = rare occurrence; less than 13 cases.

## RESULTS AND DISCUSSION

Fifty-two species of keratinophilic and cycloheximide resistant fungi representing 24 genera were collected from chicken (22 genera and 48 species) and pigeon claws (19 genera and 35 species) at 28°C (Tab. 1). All of the previous species were isolated for the first time from Egyptian birds claws, but most of them were encountered with variable frequency of occurrence from the hairs of mammals in Egypt (Bagy & Abdel-Hafez, 1985; Bagy, 1986).

The total number of keratinophilic and cycloheximide resistant fungi isolated from the claws of chickens and pigeons were 1340 and 725 colonies per 800 claws, respectively. Results reveal that there is a basic similarity between the mycoflora of the 2 types of claws with the most frequent genera: *Chrysosporium*, *Penicillium*, *Scopulariopsis*, *Aspergillus*, followed by *Mucor*, *Alternaria* and *Fusarium*.

*Chrysosporium* was the most common genus on chicken and pigeon claws, it occurred in 43% and 27% of the birds examined comprising 12.9% and 10.6% of total fungi, respectively. It was represented by 8 species of which *C. keratinophilum*, *C. tropicum* and *C. indicum* were the most prevalent on the 2 substrates; these emerged in 28, 17 and 13%; 18, 13 and 10% of the samples contributing 5.3, 2.9 and 1.7%; 4.1, 3.2 and 2.1% of total fungi, respectively. The previous 3 species were encountered, but with variable frequencies, from camel, cow, dog, donkey, goat and sheep hairs in Egypt (Bagy & Abdel-Hafez, 1985; Bagy, 1986), as well as from some mammals in Australia (Rees, 1967), Czechoslovakia (Otcenasek & Dvorak, 1962), Germany (Hoffmann & al., 1970), India (Gugnani & al., 1975) and Venezuala (Moraes & al., 1967). The remaining species were isolated in rare frequency: *Chrysosporium* state of *Thielavia sepedonium*, *C. pannorum*, *C. luteum* and *C. asperatum* on chicken claws, *Chrysosporium* state of *Thielavia sepedonium* and *C. dermatitidis* on pigeon claws. Most of the above species were frequently encountered in soils from different places all over the world (Randhawa & Sandhu, 1965; Al-Doory, 1967; Ajello & Alpert, 1972; Ajello & Padhye, 1974; Piontelli & Caretta, 1974; Caretta & Piontelli, 1975; Mostafa, 1977; Bojanovsky & al., 1979; Abdel-Fattah & al., 1982; Meissner & Qadripur, 1983; Calvo & al., 1984).

Also, truly keratinolytic fungi were isolated in various percentage counts and frequency of occurrence from the claws of any or the 2 types of birds such as *Arthroderma tuberculatum*, *Allescheria boydii*, *Ctenomyces serratus*, *Corynascus sepedonium*, *Geotrichum candidum* and *Saccharomyces* sp. These species were frequently recovered from the hairs of large mammals in some Arab countries (Bagy & Abdel-Hafez, 1985; Bagy, 1986), as well as from soils baited with various keratinolytic materials from different places of the world (Ajello & Ziedberg, 1951; Ajello, 1952, 1954; Mostafa, 1977; Abdel-Fattah & al., 1982).

*Penicillium* occupied the second place in the number of cases of isolation on chicken and pigeon claws, it emerged in 41 and 26% of the birds examined contributing 18.7 and 14.2% of total fungal counts, respectively. From the genus, 7 species were collected of which *P. chrysogenum*, *P. cyclopium* and *P. funiculosum* were the most prevalent. They occured in 11-32 and 6-20% of the birds examined giving rise to 2-10.3 and 2.1-7.2% of total fungi, respectively. *P. janthinellum*, *P. nigricans*, *P. frequentans* and *P. granulatum* were less common on claws of any or the 2 birds tested. Bagy & Abdel-Hafez (1985) isolated *P. chrysoge-*

*num, P. funiculosum, P. verruculosum* and *P. islandicum* from camel and goat hairs from Al-Arish Governorate. On the other hand, Abdel-Hafez (1987) encountered the previous 2 former species from goat and sheep hairs in Gaza Strip. *P. funiculosum* was reported from Egyptian soils baited with human hair (Abdel-Fattah & al., 1982).

*Scopulariopsis* (represented by *S. brevicaulis*) emerged from 40 and 25% of the samples encountering 16.3 and 21.2% of total moulds on chicken and pigeon claws, respectively. It is a causal agent of onychomycosis (Fragner & Belsan, 1975; Onsberg, 1980; Zaror & Frick, 1980; Velez & Diaz, 1985). This species was also recovered from hairs of large mammals (Bagy & Abdel-Hafez, 1985; Abdel-Hafez, 1987).

*Aspergillus* occurred in 38 and 25% of the samples representing 10.7 and 10.5% of total fungi on chicken and pigeon claws, respectively. It was represented by 8 species of which *A. flavus, A. zonatus* and *A. fumigatus* were the most common on the 2 types of claws; these occurred in 11-24 and 6-14% of the birds examined contributing 1.9-4.1 and 1.4-4.4% of total fungi, respectively. *A. ochraceus, A. niger* and *A. terreus* were less common on the 2 types of claws tested; but *A. nidulans* and *A. tamarii* were encountered only from chicken claws in rare frequency of occurrence and fewer counts. All of the above *Aspergillus* species were encountered, but with variable frequencies, from the hair of camel, cow, dog, donkey and goat in Egypt (Bagy & Abdel-Hafez, 1985; Bagy, 1986), as well as from goat and sheep hairs in Gaza Strip (Abdel-Hafez, 1987). Numerous members of *Aspergillus* causing aspergillosis (Frey & al., 1979) and several *Aspergillus* species were present in cases of onychomycoses (Velez & Diaz, 1985). Also, members of *Aspergillus* such as *A. niger, A. flavus, A. terreus, A. fumigatus* and *A. ochraceus* were of world-wide distribution on various substrates including air, soil, food and feedstuffs, textiles, seeds, grains and leaf surfaces of numerous plants.

*Mucor* emerged from 31 and 20% of the samples yielding 11.9 and 12.1% of total moulds on chicken and pigeon claws, respectively. Two species were collected of which *M. pusillus* was the most common, it encountered in 21 and 16% of the birds examined comprising 9.1 and 7.6% of total fungi, respectively. *M. hiemalis* was less frequent (12 and 9% of the samples, respectively). The 2 species were isolated in rare frequency of occurrence on hair of goats from Al-Arish Governorate (Bagy & Abdel-Hafez, 1985) and Gaza Strip (Abdel-Hafez, 1987).

*Alternaria* (represented by *A. alternata*) and *Rhizopus (R. stolonifer)* were recovered in moderate and low frequency of occurrence from chicken and pigeon claws, respectively. They encountered in 30 and 25%; and 14 and 13% of the birds examined comprising 7.9 and 8.8%; 1.2 and 2.6% of total moulds, respectively. These species were encountered in rare frequency from camel, goat and sheep hairs (Bagy & Abdel-Hafez, 1985; Abdel-Hafez, 1987). The above species were common in atmosphere and leaf surfaces of numerous plants as reported by several researchers.

*Fusarium* recovered from 26 and 18% of the samples constituting 6.9 and 6.1% of total fungi on chicken and pigeon claws, respectively. It was represented by 5 species of which *F. solani* (13 and 14% of the samples of the 2 types of birds, respectively) and *F. oxysporum* (10 and 6%) were the most prevalent; *F. moniliforme, F. equiseti* and *F. dimerum* were less frequent (Tab. 1). *F. solani*

was isolated from soil baited with buffalo hair (Abdel-Fattah & al., 1982). *F. oxysporum* was isolated from a case of onychomycosis of the big toenail (Disalvo & Fickling, 1980). The previous species of *Fusarium*, except *F. dimerum*, were recovered from the hairs of large mammals in Egypt (Bagy & Abdel-Hafez, 1985) and Gaza Strip (Abdel-Hafez, 1987).

Several species of cycloheximide resistant fungi such as *Acremonium strictum*, *A. rutilum*, *Verticillium catenulatum*, *Cylindrocarpon didymum*, *Botryotrichum piluliferum* and *Saccharomyces* sp. were encountered in rare frequency of occurrence from chicken and pigeon claws. On the other hand, numerous species were recovered only from any of the 2 types of substrates tested such as *Acremonium murorum*, *Verticillium chlamydosporium*, *Ulocladium atrum*, *Chaetomium spirale*, *C. globosum*, *Paecilomyces lilacinus*, *Cladosporium cladosporioides* and *Syncephalastrum racemosum* (Tab. 1). All the previous species are saprobes on various organic substrates as reported by several workers.

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